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ABSTRACT

Title: EXPLORING LEARNING FOR WORK IN THE CONTEXT OF DIGITAL WORK TECHNOLOGIES: THE SOCIOMATERIAL CASE OF ENGINEERING PROFESSIONALS IN THE CONSTRUCTION INDUSTRY

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This thesis explores the relations between engineering professionals and their digital work context and relations to their learning for work practice. In the literature on workplace learning, the digital technology driver is argued to change and impact the work practice and learning of professionals. However, there is insufficient insight into the effects of digital technologies on professional responsibilities and learning, and little was known about the actual work practice of professionals. This has possible implications for how we think about professional learning.

This thesis shows that professional learning for daily *construction planning* and *project reporting* engineering work is understood as a continuous effect of the *performing* of heterogeneous *actors*. The human and non-human *actors* perform themselves into professional action. Altogether contributing to and shaping the *construction planning* and *project reporting* work practices. Wherefore the human *actors* need the ability to *enact* upon other *actors* in the work practice for which skills and knowledge resides in the individual professional and in the practice. Learning moves beyond something that can be detached from its context or exist in a final form in individuals.

It corroborates theoretical understandings from other research in engineering that learning opportunities arise when new mediating *actors* are part of the practice, and extends this and adds, that the learning opportunities develop when sociomaterial *actors* perform themselves significantly into action in the work practice and change the work practice. Understanding the learning for professional *construction planning* and *project reporting* engineering work practices in relation to human-digital interactions may be termed as a unique sociomaterial networked relative stability. The term unique since each network is specific to the practice and to the *actors* taking part and therefore learning varies. Sociomaterial since both human and material *actors* shape and define the practice and learning. Since the *unique sociomaterial relative stability* of the network of the two daily engineering work practices of *construction planning* and *project reporting*, stabilised and set educational curriculum are increasingly challenged and thus a relative stability. Participation in real professional engineering work practice is modestly suggested to cater for this understanding about learning for professional practice.

The study was done by conducting a mixed-methods explorative sequential case-study among a small selection of engineering professionals working in the construction industry coming from three countries across the globe. The case study, drawing on sociomaterial approaches (Practice-Theory and *Actor* Network Theory), provided the exploration into the three research areas of concern: work, skills, and learning. This was done sociomaterial through identifying the *performing* of each *actor* and their connections to other constructs in the practice (tracing) seen from the practitioner view.

Survey analysis showed that the one size does not fit all in the two work practices of *construction planning* and *project reporting* applied to: the perceived intensity of work changes related to digital work technologies, the individual skills and knowledge required to be an active member of the practice, and to the learning for these individual requirements. The one size does not fit all was based on the different professional levels and different work locations.

The continued analysis of the two selected work practices of the *construction planning* and *project reporting work practices* revealed that most of the professionals in this study experienced significant changes in the professional responsibilities that they previously fulfilled and were now shared with digital technologies but varied in increased complexity and decreased complexity of their core daily engineering work practice and skill demands. This was predominantly as a result of the basic and advanced reasoning *performing* of digital technologies such as those from Simulations and Big Data. Emerging from these insights was that the concept of a unique sociomaterial network appeared relevant for the engineering professionals' *construction planning* and *project reporting* work practices.

Beyond individual professional capabilities, those emerging in practice and *enact*ed between different *actors* of the core practices were relevant to reach the common goal or outcome of the work practice for each engineering professional and the practice was then understood as a unique sociomaterial networked relative stability since the stability could change and was relative to the *performing* of heterogenous others.

The relations with the learning of the professionals was that learning happened through experience in practice, through the *performing* into professional action, through interactions and coordination with other *actors*, complemented with a diverse professional knowledge base to *enact* upon other *actors* such as digital technologies in their work. Learning mechanisms such as learning by trying and using intuition were common to practice the know-how of their work and learning during schooling was found to develop the individual knowledge foundation that had preceded their work. Learning was thus understood to be residing in the individual engineering professional and in the selected core work practices of *construction planning* and *project reporting* and changed in the light of these practices. However, a stronger relative stability was found in learning from others and work experience while the academic knowledge base was acknowledged being important before transferring to work.